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April 10, 2001

Magalie R. Salas, Secretary
Federal Communications Commission
The Portals Building
445 12th Street, SW TW-A325
Washington, DC 20554

Re: **Erratum IB Docket No. 00-248**
2000 Biennial Regulatory Review
Streamlining and Other Revisions of
Part 25 of the Commission's Rules Governing the
Licensing of, and Spectrum Usage by,
Satellite Network Earth Stations and Space Stations

Dear Ms. Salas:

Attached please find a corrected copy of the "Comments of the PanAmSat Corporation" filed March 26, 2001, in the above-referenced proceeding. The erratum corrects two minor errors.

On page 10, paragraph 2, line 6, the figure "-24dBW / Hz" should read "-26dBW / Hz." Also, the attached link budgets inadvertently omitted the link budget for "Minn to 49 dBW Kzone, -24dBW / Hz" and repeated the link budget for "Minn to 49 dBW Kzone, -30dBW / Hz" twice. Please substitute this corrected version.

Please direct any questions concerning this matter to the undersigned.

Respectfully submitted,

/s/ Joseph A. Godles
Joseph A. Godles

Attorney for
PanAmSat Corporation

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
2000 Biennial Regulatory Review	)	IB Docket No. 00-248
Streamlining and Other Revisions of Part 25	)	
Of the Commission's Rules Governing the	)	
Licensing of, and Spectrum Usage by, Satellite	)	
Network Earth Stations and Space Stations	)	

COMMENTS OF PANAMSAT CORPORATION

Joseph A. Godles

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March 26, 2001

SUMMARY

In these Comments, PanAmSat takes the following positions concerning the proposals in the NPRM:

Non-standard antenna patterns. PanAmSat favors liberalizing the processing rules for earth stations with non-standard antenna patterns. To that end, PanAmSat supports a change in the off-axis angle – presently set at one degree - that triggers the requirement for satisfying the 29-25 log theta standard. PanAmSat suggests that the satellite industry, on an informal basis, be given an opportunity to come up with the new off-axis angle trigger; discussions are already underway on these and other issues.

Although PanAmSat believes that the Commission's proposal for an "equivalent protection" power reduction standard merits consideration, its preliminary view is that the proposal goes too far. By eliminating the bright line between conforming and non-conforming antennas, the proposal would reduce the certainty that facilitates planning and coordination.

PanAmSat fears that adopting an equivalent protection standard – particularly if accompanied by the affidavit procedure the Commission has proposed – would impose an unprecedented burden on satellite operators to evaluate large numbers of non-standard earth stations. Earth stations lacking standard patterns could proliferate, without any interference review by the Commission, and under circumstances in which it would be extremely difficult to identify and correct interference should it arise. A proliferation of non-standard antennas would impose coordination constraints that could significantly limit the flexibility of satellite operators to accommodate new services or to restore service following a satellite anomaly.

Submission of antenna gain patterns. PanAmSat supports the Commission's proposal to require submission of non-routine antenna gain patterns with earth station applications, and suggests that the Commission also require that applications for such earth stations be served on potentially affected satellite operators.

Non-routine power levels. PanAmSat opposes the proposed self-certification procedure for earth stations that operate at power levels higher than those specified in Part 25. Under this procedure, the earth station operator wishing to operate at higher power, and the space station operator wishing to secure or retain the earth station operator as a customer, would be the ones determining whether higher power operation is consistent with existing or new coordination agreements, presenting an irreconcilable conflict of interest. Adjacent satellite operators who might disagree with the conclusions underlying a certification, moreover, would not have a reasonable opportunity to conduct an independent evaluation, because the applicant would not have to prepare and file an interference analysis, and absent this information it would be burdensome, if not impossible, for the operators to identify and evaluate interference issues.

Relaxation of power density limits. PanAmSat supports relaxation of the earth station power density limits. Based on link budgets that PanAmSat has prepared and attached to its comments, an increase in the downlink EIRP density would be technically acceptable.

Temporary fixed earth stations. PanAmSat supports the Commission's proposal to permit operators of temporary fixed earth stations in the Ku-band to commence operation prior to grant, but believes that their authority to operate

should not commence until the end of the comment period, and only if no objections have been filed.

License term. PanAmSat supports the Commission's proposal to extend the license term for earth stations to 15 years.

VSAT licensing. PanAmSat supports the Commission's proposals to permit multiple hub stations under a single VSAT network blanket license and to authorize temporary fixed VSAT hub stations.

Consumer terminals. PanAmSat asks that the Commission take this opportunity to address issues raised by the proliferation of two-way consumer terminals. These terminals raise special interference concerns, because each system has vast numbers of terminals; many of the terminals will be installed by untrained consumers; and many system designs call for dynamic re-assignment of transmit frequencies, making it particularly difficult to identify the source of interference. PanAmSat proposes operating requirements that could be adopted for such systems to insure that interference from improperly installed or malfunctioning systems does not harm other satellite users.

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FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C. 20554

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Network Earth Stations and Space Stations	)	

COMMENTS OF PANAMSAT CORPORATION

PanAmSat Corporation ("PanAmSat"), by its attorneys, hereby comments upon the Notice of Proposed Rulemaking ("NPRM") in the above-captioned proceeding.[1]

DISCUSSION

I. Streamlining Non-Routine Earth Station Licensing Process

A. Non-Routine Antenna Gain Patterns

1. Licensing

Transmit antennas. The Commission has proposed procedures that would make it easier for applicants to obtain licenses for antennas that do not satisfy the requirements for "routine processing." These requirements are an adjunct to the Commission's rules for creating an environment in which satellites can operate at two-degree spacing.

In particular, the Commission has proposed that an applicant for an earth station having a non-routine antenna gain pattern be able to obtain a license if it: (1) reduces power to a level equivalent to that produced by an antenna that is two-degree

compliant; or (2) provides affidavits from the operator(s) of the satellite(s) with which the earth station will communicate certifying that the proposed operations have been coordinated with affected satellite systems, and that the operations will be taken into account in future coordination negotiations. Applicants satisfying one of these alternatives would not be required to submit an interference analysis employing the "ASIA" program. For reasons that are discussed below, PanAmSat believes that the this proposal may go too far in opening the door to earth stations lacking standard gain patterns, and that the industry should be given an opportunity to give the matter additional study.

The Commission's proposal stems from objectives that PanAmSat shares. Advances in space station power and technology have made it possible to provide a variety of new and innovative services using earth stations that do not conform to the current standards for routine processing. PanAmSat seeks rules that will facilitate its efforts provide high quality services that are competitive with fiber and other terrestrial delivery systems and to meet the needs of rural and underserved areas.

The Commission needs to strike a balance, however, between the potential benefits of non-conforming earth stations, and the burdens that these earth stations may impose - by increasing interference, expanding monitoring obligations, and complicating coordination - on satellite operators, users, and the Commission itself. As the Commission has recognized, "smaller antennas produce wider transmission beams, which, in turn, create more potential interference to adjacent satellite operations."[2] Wider transmission beams (and corresponding wider receive beams) ultimately limit the antenna size in the current two degree spacing satellite environment. Because of this phenomenon, smaller earth stations also magnify the interference impact of antenna mispointing, an all too common occurrence in the industry.

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[1] FCC 00-248 (Dec. 14, 2000).

[2] NPRM ¶ 7.

The Commission needs to proceed with caution in this area, because a misstep could undo years of careful effort to create an environment in which satellites could live compatibly at two degree spacing. Reliable service has been a hallmark of the U.S. satellite industry, and must continue for the industry to thrive.

PanAmSat fears that the proposals in the NPRM place undue emphasis on the goal of facilitating non-standard antenna patterns at the expense of other important objectives. PanAmSat agrees with the Commission that the current rules are unduly restrictive, and favors making it easier for non-conforming earth stations to be licensed. In liberalizing its requirements, however, PanAmSat believes that the Commission should strive to maintain the bright line that presently exists between earth stations that may be routinely processed and those that may not.

To that end, PanAmSat would support a change in the off-axis angle -- presently set at one degree -- that triggers the requirement for satisfying the 29-25 log theta standard. Following a change of this nature, it would remain a simple matter for parties to determine on a "go/no go" basis whether routine processing was available. Earth stations not conforming to the new standard would continue to be required to conduct an interference analysis to protect the integrity of satellite networks.

PanAmSat suggests that the industry be given an opportunity to address what the appropriate new angle should be. PanAmSat and other satellite operators have already initiated discussions on an informal basis concerning this issue and other issues raised by the NPRM. The parties are attempting to develop a consensus position.

PanAmSat believes that the Commission's proposal for an "equivalent protection" power reduction standard also merits study in the context of these industry discussions. PanAmSat's preliminary view, however, is that the proposal goes too far. By eliminating the bright line standard that presently exists, it would reduce the certainty that facilitates planning and coordination. Each non-conforming earth station would have to be evaluated on its individual merits, placing an unprecedented burden

on the operators of potentially affected satellites. Large numbers of earth stations lacking standard patterns could proliferate, without any interference evaluation by the Commission, and under circumstances in which it would be extremely difficult to identify and correct interference should it arise. A proliferation of non-standard antennas also would impose coordination constraints that could significantly limit the flexibility of satellite operators to accommodate new services or to restore service following a satellite anomaly.

PanAmSat recognizes that the present system is far from perfect. In particular, PanAmSat acknowledges that the requirement to conduct an ASIA analysis can be burdensome for earth station applicants. By changing the starting point for the 29-25 log theta requirement, however, many more small earth stations could be authorized on a routine basis, without the need for an ASIA analysis. If the Commission takes PanAmSat up on its suggestion for industry review, moreover, it would be appropriate for the industry to examine whether it is possible to modify or streamline the ASIA process.

Finally, PanAmSat believes it premature to consider procedures for securing sign-offs from adjacent satellite operators for non-compliant earth stations. One needs to know what the standard for non-routine earth stations will be before coming up with a procedure for enforcing the standard. In any event, for reasons that are discussed below in connection with earth stations employing non-routine power levels,[3] PanAmSat believes that the affidavit procedure that has been proposed would place decisions concerning interference in the wrong hands, and would create an unfair burden for adjacent satellite operators.

Receive antennas. Nothing adopted in this proceeding should be viewed as providing interference protection for a receive antenna with a non-standard pattern. If

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[3] See Section I.B of these Comments.

such an antenna receives interference from a space station that is two-degree compliant, then the interference should have to be accepted.

2. Submission of antenna gain patterns

PanAmSat supports the Commission's proposal that, as a matter of course, applicants seeking to use non-routine antennas be required to submit antenna gain patterns with their applications. This information inevitably will be requested anyway, and having the applicant file it up front will save time.

As a further time saving measure, PanAmSat suggests that the Commission require applicants for non-routine antennas to serve their applications, with patterns included, on the operators of all co-frequency satellites with six degrees of the eastern and western edges of the coordination arc specified in the earth station application. A service requirement would enable the adjacent satellite operators to begin their evaluation at an earlier stage and provide a greater opportunity to resolve interference issues with the applicant prior to the expiration of the comment period. The impact of a service requirement on the applicant would be minimal, because there is a limited universe of satellite operators.

3. Stationkeeping tolerances

The Commission seeks comment as to whether increasing the number of earth stations that do not conform to the off-axis requirements of 25.209(a)(1) "would unreasonably increase the likelihood of unacceptable interference given the station keeping tolerances of current satellite systems."[4] This is another issue that PanAmSat believes should be explored in industry discussions.

The wider transmit beams inherent in small antennas combined with stationkeeping tolerances of satellites can increase interference concerns for adjacent

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[4] NPRM ¶ 27.

satellites. Antennas that are aligned to a satellite at the edge of its stationkeeping box are biased in a way that reduces the nominal two degree spacing between co-frequency satellites by the size of the stationkeeping tolerance. The wider the stationkeeping tolerance, the greater the bias in pointing. The wider the transmit beam, the greater the interference impact on the adjacent satellite. PanAmSat plans to discuss the interaction of these two effects with other industry members in an effort to develop an appropriate standard.

4. Interleaved satellites

The spatial isolation of beams on interleaved satellites provides protection against all but gross antenna pointing errors. The introduction of antennas that do not satisfy the antenna gain pattern envelope at less than two degrees off-axis, therefore, should not significantly increase the risk of interference.

B. Non-Routine Power Levels

The Commission has proposed a new procedure for addressing earth stations that operate at power levels higher than those specified in Part 25. Under this new procedure, the proponent of an earth station having higher than routine power would not have to analyze in its application the potential for the earth station to cause harmful interference to adjacent satellites. Instead, the applicant merely would certify that it will comply with all coordination agreements reached by the operator(s) of the satellite(s) it is communicating with, or if it could not comply, it would reduce power to routine levels to resolve the compliance issue. In addition, the applicant would need to provide a statement from the satellite operator(s) acknowledging the operation of an earth station with higher than routine power; representing that operation at the higher power is consistent with existing coordination agreements with other satellite operators; and committing to include operation at the higher power in all future coordination agreements with other satellite operators.

PanAmSat opposes this proposal. The self-certification procedure envisioned by the Commission would create an unavoidable conflict of interest. The earth station operator wishing to operate at higher power, and the space station operator wishing to secure or retain the earth station operator as a customer, would be the ones determining whether higher power operation is consistent with existing or new coordination agreements; how to evaluate interference potential; and which adjacent satellite operators must be coordinated with. Needless to say, it would be in the interest of these parties to conclude that there is no harmful interference and no inconsistency with coordination agreements.

Adjacent satellite operators who might disagree with the conclusions underlying a certification would not have a reasonable opportunity to conduct an independent evaluation, because the proposed procedure lacks transparency. The earth station applicant would file only a certification, rather than an interference analysis, so the adjacent satellite operator would not have the benefit of the applicant's thinking. Although it might be possible for the adjacent satellite operator to prepare its own interference analysis, it is unrealistic to think that the adjacent operator will: (1) monitor all earth station applications; (2) identify those that include certifications from the operators of satellites at nearby orbital locations; (3) conduct an interference analysis for all such applications; (4) compare the results of the interference analysis to the limits that have been agreed to in its coordination agreements; and (5) re-do the analysis for these earth stations every time it enters into a new or modified coordination agreement.

In short, the proposed self-certification procedure improperly gives the responsibility for making interference determinations to the parties who have an incentive to find that there is no interference, and makes it burdensome, if not impossible, for the operators who might be affected by such interference to identify and evaluate interference issues.

C. Satellite Coordination Negotiations to Reflect Non-Routine Power Levels

The Commission has proposed a revised coordination procedure for earth stations employing non-routine antennas and power levels. Under the revised procedure, interested parties would continue to have 30 days to file comments or raise interference issues, including issues concerning interference to satellites located more than six degrees away. In addition, at the end of the 30 day comment period, there would be a new 60 day period within which to attempt to resolve interference issues. At the end of the 60 days, the Commission would authorize the earth station "to communicate at its requested higher power levels with all satellites for which it has submitted affidavits, and for which there are no unresolved objections to the application."[5]

PanAmSat opposes this proposal. The proposal is intended to implement the self-certification process which, for reasons identified in the preceding section, PanAmSat considers ill advised. In addition, if the Commission were to adopt a self-certification procedure notwithstanding the objections PanAmSat has raised, PanAmSat believes that the appropriate course would be to require applicants, working through their satellite operator(s), to notify adjacent satellite operators within six degrees on either side, and to attempt to resolve coordination issues involving those adjacent satellite operators, before an application proposing non-routine power is filed. There is no point in paving the way for a flood of applications at the Commission when many of the applications may never clear coordination.

D. Public Notice Language

PanAmSat supports the Commission's proposal that applicants submit with their applications the language that will appear in the public notice. As a further streamlining measure, PanAmSat urges the Commission to explore whether, in revising the earth station application form for electronic filing, it would be possible to

incorporate fields that, once completed by the applicant, would enable the Commission to generate a public notice automatically.

PanAmSat also suggests that the Commission expand the information identified in the NPRM that would appear in the public notice to include the following: (a) in addition to the diameter of the dish, the antenna gain and cross-polarization information; (b) the eastern and western boundaries of the arc the applicant is seeking to coordinate; and (c) the modulation scheme for any random access technique.

II. Relaxation of Current Requirements

A. Relaxation of Earth Station Power and Power Density Limits

1. Power levels

The Commission seeks comment on whether the power density limits specified in Sections 25.134, 25.211, and 25.212 of the rules should be relaxed to take into account technological advances and smaller antenna requirements. PanAmSat believes that a relaxation of these power limits is warranted.

As to the power level limits that apply to VSAT licensing, for example, an increase in the downlink EIRP density from the current +6 dBW/4 KHz would be technically acceptable. In fact, wide band digital carriers operating at saturation on PanAmSat, GE Americom and Loral Skynet satellites already exceed this limit in cases in which the increased operating levels have been coordinated with adjacent satellite operators.

To demonstrate the impact to a VSAT network by an increase in the downlink EIRP density level, link budgets (see attached) using typical VSAT carrier parameters have been evaluated. Two such increases were studied. The first was a 4 dB increase in the downlink EIRP density limit and the second was a 6 dB increase in the limit.

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[5] NPRM ¶ 35.

Three link budgets (see attached) using a 512 kbps BPSK R1/2 outroute from a 6.1-meter antenna into a 1.2 meter antenna were analyzed. The reference link budget uses a value of –30 dBW/Hz (+6 dBW/4 kHz) for the downlink EIRP density on both sides of the wanted satellite. The other two link budgets use the identical parameters except for the change in the downlink EIRP density values to –26 dBW/Hz and –24 dBW/Hz. For the inroutes two links were analyzed using typical carrier parameters of 128 kbps BPSK R1/2.

The results demonstrate that an increase in ASI levels on both sides of the wanted satellite (two degree separation) by 4 dB has the effect of introducing degradation in the composite C/N+I of about 0.7 dB. A 6 dB increase causes a degradation of 1.3 dB. The impact to the composite C/N+I in the inroute case is about 0.2 dB with a 6 dB increase in the ASI. Given that most link budgets have a 1 dB system margin, it can be seen that the –26 dBW/Hz downlink EIRP density level can be tolerated. In fact, as discussed above, in many cases these higher downlink EIRP density levels have been coordinated and are in use.

2. Definitions

In connection with the power density limits, the Commission asks whether the terms "narrowband" and "wideband" should be defined or clarified. PanAmSat believes it would be beneficial to have a uniform definition for these terms for digital services. To achieve additional clarity, PanAmSat suggests establishing several subcategories of wideband service, and linking the definitions to particular transponder modes of operation.

PanAmSat recommends the following definitions for digital carriers: "Narrow band" would be defined as any carrier below 3 MHz operating in a multi-carrier mode. "Single wide band" would be defined as carrier bandwidth close to entire transponder bandwidth at or close to saturation. "Dual wide band" would be defined as carrier bandwidth close to ½ transponder bandwidth operating at ½ transponder power.

"Multiple wide band" would be defined as carrier bandwidth above 3 MHz operating in multi-carrier mode.

B. Temporary Fixed Earth Stations

With one exception, PanAmSat supports the Commission's proposal to permit operators of temporary fixed earth stations in the Ku-band to commence operation prior to grant. This procedure would apply to "routine" earth stations communicating with U.S. licensed satellite systems and non-U.S. licensed systems that are on the "Permitted List."

The exception concerns when a temporary fixed operator may proceed. The Commission has proposed that the operator would be able to begin transmitting as soon as its application appears on public notice as accepted for filing. PanAmSat suggests moving the start date to the end of the 30-day comment period following the release of the public notice, and limiting the "automatic authority" to applications that are not opposed within the 30-day period, so that if issues arise, they are apparent before the applicant is able to transmit.

C. License Term

The Commission has proposed extending the license term for earth stations from 10 years to 15 years. PanAmSat supports this proposal, which will reduce the burdens on the Commission and licensees associated with license renewals.

III. VSAT Licensing Issues

A. Multiple Hub Stations

The Commission's has proposed to permit multiple hub stations under a single VSAT network blanket license. PanAmSat assumes that, if this proposal were adopted, the location and operating parameters for each hub station would be specified in the VSAT license. With that caveat, PanAmSat supports the Commission's proposal.

B. Temporary Fixed VSAT Hubs

In the NPRM, the Commission invites comment as to whether it should authorize temporary fixed VSAT hub stations, and if so, whether the requirements in the rules that already apply to VSAT hubs, such as the EIRP limit in Section 25.134, also should apply to temporary fixed VSAT hubs. PanAmSat has no objection to the Commission's proposal, so long as it is made clear that temporary fixed VSAT hub stations must comply with all Part 25 requirements.

IV. Consumer Terminals

In the NPRM, the Commission "invite[s] commenters to make additional proposals and suggestions."[6] PanAmSat believes that the Commission should take this opportunity to address issues raised by the proliferation of two-way consumer terminals. These terminals raise special interference concerns, and PanAmSat urges the Commission to adopt certain requirements that will minimize interference risks while allowing for the proliferation of these services. PanAmSat believes that a number of companies already employ the safeguards it is proposing.

Many of the newly proposed satellite-based consumer products are two-way systems in which the end user of the system both transmits to and receives signals from geostationary satellites. The interference risks posed by such two-way consumer services are enormous given the number of antennas to be fielded and the manner in which they will be installed. Business models of such systems assume that "subscribers" of such a service number in the hundreds of thousands and could easily number in the millions of subscribers (and thus subscriber terminals) over time. Nearly all product business plans assume that some percentage of system installations will be performed by the consumer.[7] And many system designs call for dynamic re-

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6 NPRM ¶ 91.

7 Satellite operators already spend countless hours and dollars to monitor their spectrum to identify and remove the sources of interference from VSAT terminals, which are far fewer per system than the

assignment of transmit frequencies, making it particularly difficult to identify the source of interference.

Special operating conditions need to be instituted on such systems to insure that interference from improperly installed or malfunctioning systems does not harm other satellite users. PanAmSat proposes that at a minimum the Commission require the following operating conditions:

- System equipment design must inhibit transmit capability of the unit until such time as correct pointing of the antenna can be quantifiably confirmed. Quantifiable pointing measurements shall include but not be limited to measurements of cross-polarization isolation and azimuth and elevation pointing.

- System equipment design must allow transmit capability to be disabled remotely from a central operations center at all times. Further, the equipment design must inhibit the end-user from being able to override the "transmit disable" function.

- Transmit antenna installations must be performed by a professional antenna installer unless and until the system operator demonstrates a means by which quantifiable pointing verification can be made remotely and the transmit function can be disabled until specified antenna pointing performance is achieved.

- System design shall include a means by which interference can be traced to individual subscribers on the basis of satellite, polarization, frequency, time of occurrence, length of occurrence, and other such data as can reasonably be provided by satellite operators. Such subscriber tracing shall be capable of being performed within a matter of minutes. For those systems that dynamically re-assign transmit frequencies to subscribers, system design shall be capable of maintaining records of frequency assignment at reasonable intervals of time to facilitate the location of interference sources.

- Excessive interference problems caused by a system operator shall lead to a review of the system's design and possibly increased operating restrictions or revocation of system operating license.

Operating restrictions on two-way consumer systems are essential to insure that all satellite users are protected from interference. Simple extrapolation of current

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numbers of terminals projected for two-way consumer products, and which (unlike many two-way consumer terminals) are professionally installed.

interference problems to the potential number of transmit antennas shows that interference issues could easily become operationally significant to both the system operator and to other satellite users. Reliability or quality of service issues that are actually caused by preventable interference problems can impair the perceived value of the service and undermine the success of the service as a whole. Interruptions to other satellite users as a result of preventable interference issues can also adversely affect the perception of satellite reliability and feasibility for particular types of services. Adopting operating restrictions that enable problems to be prevented -- and easily resolved when they do occur -- is critical for maintaining the viability of all satellite services.

CONCLUSION

For the reasons set forth herein, the Commission should revise its Part 25 rules in the manner described herein.

Respectfully submitted,

PANAMSAT CORPORATION

By: /s/ Joseph A. Godles
Joseph A. Godles

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Its Attorneys

March 26, 2001

LINK BUDGETS

Minn to 49 dBW Kzone, -30 dBW/Hz

SATELLITE DATA	Satellite : Galaxy-XI,91W		Location: 91.0 deg W Lon		
	Uplink Beam: N_AMERICA_KVUP		Dnlink Beam: N_AMERICA_KHDN		
	Uplink POL: V, Dnlink POL: H, EIRP, beam center: 49.69 dBW				
	G/T:4.0 dB/K, SFD:-89.8 dBW/m2		Dnlink EIRP: 49 dBW		
TRANSPONDER DATA	Trans Bandwidth :36.0 MHz		Trans Type: TWTA		
	Uplink Frequency:14.180 GHz		Dnlink Freq: 11.880 GHz		
	Aggregate IBO : 8.0 dB		Aggregate OBO: 4.6 dB		
CARRIER DATA	Type: EF300, Info Rate: 512 kbps, Mod: BPSK, 1/2-V				
	BWo: 1146.9kHz, BWa: 1450kHz, C/Nnom: 4.10dB, C/Nmin: 3.00d				
	LINK BUDGET			CLR SKY	UP FADE	DN FADE
UPLINK PERFORMANCE	Earth Station EIRP		(dBW)	50.2	50.2	50.2
	- Uplink Path Loss, clear sky		(dB)	-207.1	-207.1	-207.1
	- Uplink Rain Attenuation		(dB)	0.0	-2.9	0.0
	+ Satellite G/T		(dB/K)	4.0	4.0	4.0
	- Boltzman's Constant		(dBW/K-Hz)	228.6	228.6	228.6
	- Carrier Noise Bandwidth		(dB-Hz)	-60.6	-60.6	-60.6
	C/N Uplink		(dB)	15.2	12.3	15.2
DOWNLINK PERFORMANCE	Satellite Saturation EIRP		(dBW)	49.0	49.0	49.0
	- Carrier Output Backoff		(dB)	-19.1	-22.0	-19.1
	Downlink EIRP per carrier		(dBW)	29.9	27.0	29.9
	- Dnlink Path Loss, clear sky		(dB)	-205.4	-205.4	-205.4
	- Dnlink Rain Degradation		(dB)	0.0	0.0	-5.6
	- Antenna Pointing Error		(dB)	-.5	-.5	-.5
	+ Earth Station G/T, clear sky		(dB/K)	19.4	19.4	19.4
	- Boltzman's Constant		(dBW/K-Hz)	228.6	228.6	228.6
	- Carrier Noise Bandwidth		(dB-Hz)	-60.6	-60.6	-60.6
	C/N Dnlink		(dB)	11.4	8.5	5.8
COMPOSITE PERFORMANCE	C/N Uplink		(dB)	15.2	12.3	15.2
	C/N Dnlink		(dB)	11.4	8.5	5.8
	C/I Intermod		(dB)	14.6	11.9	14.6
	C/I Uplink Co-channel		(dB)	26.5	23.6	26.5
	C/I Dnlink Co-Channel		(dB)	26.5	23.6	26.5
	C/I Uplink Adj. Sat. (TELS4)		(dB)	17.0	14.1	17.0
	C/I Dnlink Adj. Sat. (TELS4)		(dB)	19.3	16.4	19.3
	C/I Uplink Adj. Sat. (TELS6)		(dB)	17.0	14.1	17.0
	C/I Dnlink Adj. Sat. (TELS6)		(dB)	19.3	16.4	19.3
	C/(N+I) COMPOSITE		(dB)	6.9	4.0	4.0
	- Required System Margin		(dB)	-1.0	-1.0	-1.0
	Net C/(N+I) COMPOSITE		(dB)	5.9	3.0	3.0
	- Minimum Required C/N		(dB)	-4.1	-3.0	-3.0
	Excess Link Margin		(dB)	1.8	0.0	0.0
TRANSPONDER UTILIZATION	% BW/CARR: 4.03, % PWR/CARR: 3.55, Max No. Carriers: 24.8					
	Downlink EIRP per carrier toward beam center: 30.6 dBW					
TRANSMIT	Loc: USA__Minneapolis__ ID:KPK		AZ: 176.7 Elev: 38.1			

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|EARTH STA.  |EIRP per carrier: 50.2 dBW,   Carrier Pwr: 0.2 watts        |
|------------------------------------------------------------------------|
|RECEIVE E.S.|Loc: 49 dBW            ID:STANDARD    AZ: 166.2 Elev: 42.8 |
|------------------------------------------------------------------------|
|INTERFERENCE|Uplink Pwr Den: -67.5 dBW/Hz, Dnlink EIRP Den: -30.0 dBW/Hz |
|INFORMATION |Max Dnlink PFD: -156.5 dB(W/m2/4kHz) @ Beam Center          |
|------------------------------------------------------------------------|
|LINK        |Uplink: Zone K ,  Dnlink: Zone K                           |
|AVAILABILITY|Uplink: 99.92 %,  Dnlink: 99.95 %,  Composite Link: 99.87 % |
|------------------------------------------------------------------------|
|LOSS DUE TO ADJ. SAT. INTERFERENCE: TELS4 = 0.73dB, TELS6 = 0.73dB      |
--------------------------------------------------------------------------

Minn to 49 dBW Kzone, -30 dBW/Hz
[ Input Data ]

--------------------------------- SATELLITE ---------------------------------

Satellite Name  : Galaxy-XI,91W        Location (deg W): 91.0 deg W
Uplink Beam     : N_AMERICA_KVUP       Dnlink Beam     : N_AMERICA_KHDN
Trans. BW  (MHz): 36.0 MHz             Trans. Type     : TWTA
Uplink Pol.     : V                    Dnlink Pol.     : H
Uplink Chan.    : 9K                   Dnlink Chan.    : 9K
Uplink Frequency     (GHz): 14.180     Dnlink Frequency     (GHz): 11.880
G/T, beam center    (dB/K): 4.81       EIRP, beam center    (dBW): 49.69
G/T, beam edge      (dB/K): 1.0        EIRP, beam edge      (dBW): 46.0
G/T, toward Tx ES   (dB/K): 4.0        EIRP, toward Rx ES   (dBW): 49
SFD, beam edge    (dBW/m2): -86.8
SFD, toward Tx ES (dBW/m2): -89.8

--------------------------- OPERATING CONDITIONS ---------------------------

Attenuator Setting (dB): 8.0           Nominal Uplink Co-Chan C/I (dB): 27.0
Input Backoff      (dB): 8.0           Nominal Dnlink Co-Chan C/I (dB): 27.0
Output Backoff     (dB): *             Minimum Uplink Rain Margin (dB):  3.5
(C/Im) - Nominal   (dB): *             Actual  Uplink Rain Margin (dB):  2.9
Min. System Margin (dB): 1.0           Uplink Power Control Margin(dB):  .0
Max No Carriers / Trans: 28.15         Minimum Dnlink Rain Margin (dB):  4.5
Required Link Availability: N/A        Actual  Dnlink Rain Margin (dB):  5.6
                                       Dnlink Pointing Error      (dB):  0.5

-- ADJACENT SATELLITE INTERFERENCE ----- Sat. No. 1 -------- Sat. No. 2 -----

Interfering Satellite Name           :      TELS4              TELS6
Interfering Satellite Location(deg W):      89.0               93.0
Uplink Interference    (dB or dBW/Hz):      -46.0              -46.0
Uplink Polarization Advantage    (dB):      0.0                0.0
Downlink Interference  (dB or dBW/Hz):      -30                -30
Downlink Polarization Advantage  (dB):      0.0                0.0
Tx E/S Topocentric Angle        (deg):      2.11               2.11
Rx E/S Topocentric Angle        (deg):      2.13               2.13
Rx E/S Adj. Sat. Discrimination  (dB):      20.5               20.5

--------------------------- CARRIER PARAMETERS ---------------------------

Modem Type     : EF300                 C/N         (clear sky, dB): 4.10
Modulation     : BPSK                  Eb/No       (clear sky, dB): 7.6
Code Rate      : 1/2-V                 C/N   (rain conditions, dB): 3.00
Info Rate (kbps): 512                  Eb/No (rain conditions, dB): 6.5
Occupied Bandwidth  (kHz): 1146.9
Allocated Bandwidth (kHz): 1450
```

------ Transmit Earth Station ------		------- Receive Earth Station -------	
Location: USA__Minneapolis__MN		Location: 49 dBW	
Latitude (deg N):	45.0	Latitude (deg N):	40
Longitude (deg W):	93.3	Longitude (deg W):	100
Altitude (m):	*	Altitude (m):	*
CCIR Rain Zone :	K	CCIR Rain Zone :	K
E/S Type or Model No:	KPK	E/S Type or Model No:	STANDARD
E/S Manufacturer :	Vertex	E/S Manufacturer :	
E/S Diam. (m):	6.1	E/S Diam. (m):	1.2
E/S Freq (nom, GHz):	14.250	E/S Freq (nom, GHz):	11.95
E/S Tx Gain (dBi):	57.15	E/S Gain (nom, dBi):	41.3
ULPC Margin (dB):	.0	E/S Feed Loss (dB):	0.25
		E/S Ant. Temp(deg K):	45
		E/S LNA Temp (deg K):	85
		E/S G/T (nom, dB/K):	*

Minn to 49 dBW Kzone, -26 dBW/Hz

SATELLITE DATA	Satellite : Galaxy-XI,91W		Location: 91.0 deg W Lon		
	Uplink Beam: N_AMERICA_KVUP		Dnlink Beam: N_AMERICA_KHDN		
	Uplink POL: V, Dnlink POL: H, EIRP, beam center: 49.69 dBW				
	G/T:4.0 dB/K, SFD:-89.8 dBW/m2		Dnlink EIRP: 49 dBW		
TRANSPONDER DATA	Trans Bandwidth :36.0 MHz		Trans Type: TWTA		
	Uplink Frequency:14.180 GHz		Dnlink Freq: 11.880 GHz		
	Aggregate IBO : 8.0 dB		Aggregate OBO: 4.6 dB		
CARRIER DATA	Type: EF300, Info Rate: 512 kbps, Mod: BPSK, 1/2-V				
	BWo: 1146.9kHz, BWa: 1450kHz, C/Nnom: 4.10dB, C/Nmin: 3.00d				
	LINK BUDGET			CLR SKY	UP FADE	DN FADE
UPLINK PERFORMANCE	Earth Station EIRP	(dBW)		50.2	50.2	50.2
	- Uplink Path Loss, clear sky	(dB)		-207.1	-207.1	-207.1
	- Uplink Rain Attenuation	(dB)		0.0	-2.2	0.0
	+ Satellite G/T	(dB/K)		4.0	4.0	4.0
	- Boltzman's Constant	(dBW/K-Hz)		228.6	228.6	228.6
	- Carrier Noise Bandwidth	(dB-Hz)		-60.6	-60.6	-60.6
	C/N Uplink	(dB)		15.2	13.0	15.2
DOWNLINK PERFORMANCE	Satellite Saturation EIRP	(dBW)		49.0	49.0	49.0
	- Carrier Output Backoff	(dB)		-19.1	-21.3	-19.1
	Downlink EIRP per carrier	(dBW)		29.9	27.7	29.9
	- Dnlink Path Loss, clear sky	(dB)		-205.4	-205.4	-205.4
	- Dnlink Rain Degradation	(dB)		0.0	0.0	-5.0
	- Antenna Pointing Error	(dB)		-.5	-.5	-.5
	+ Earth Station G/T, clear sky	(dB/K)		19.4	19.4	19.4
	- Boltzman's Constant	(dBW/K-Hz)		228.6	228.6	228.6
	- Carrier Noise Bandwidth	(dB-Hz)		-60.6	-60.6	-60.6
	C/N Dnlink	(dB)		11.4	9.2	6.4
	C/N Uplink	(dB)		15.2	13.0	15.2
	C/N Dnlink	(dB)		11.4	9.2	6.4
	C/I Intermod	(dB)		14.6	12.5	14.6
	C/I Uplink Co-channel	(dB)		26.5	24.3	26.5
	C/I Dnlink Co-Channel	(dB)		26.5	24.3	26.5
	C/I Uplink Adj. Sat. (TELS4)	(dB)		17.0	14.8	17.0
	C/I Dnlink Adj. Sat. (TELS4)	(dB)		15.3	13.1	15.3
	C/I Uplink Adj. Sat. (TELS6)	(dB)		17.0	14.8	17.0
	C/I Dnlink Adj. Sat. (TELS6)	(dB)		15.3	13.1	15.3
COMPOSITE PERFORMANCE						
	C/(N+I) COMPOSITE	(dB)		6.2	4.0	4.0
	- Required System Margin	(dB)		-1.0	-1.0	-1.0
	Net C/(N+I) COMPOSITE	(dB)		5.2	3.0	3.0
	- Minimum Required C/N	(dB)		-4.1	-3.0	-3.0
	Excess Link Margin	(dB)		1.1	0.0	0.0
TRANSPONDER UTILIZATION	% BW/CARR: 4.03, % PWR/CARR: 3.55, Max No. Carriers: 24.8					
	Downlink EIRP per carrier toward beam center: 30.6 dBW					
TRANSMIT EARTH STA.	Loc: USA__Minneapolis__ ID:KPK		AZ: 176.7 Elev: 38.1			
	EIRP per carrier: 50.2 dBW,	Carrier Pwr: 0.2 watts				

```
|RECEIVE E.S.|Loc: 49 dBW            ID:STANDARD    AZ: 166.2 Elev: 42.8 |
|------------------------------------------------------------------------|
|INTERFERENCE|Uplink Pwr Den: -67.5 dBW/Hz, Dnlink EIRP Den: -30.0 dBW/Hz |
|INFORMATION |Max Dnlink PFD: -156.5 dB(W/m2/4kHz) @ Beam Center          |
|------------------------------------------------------------------------|
|LINK        |Uplink: Zone K ,  Dnlink: Zone K                           |
|AVAILABILITY|Uplink: 99.87 %,  Dnlink: 99.93 %,  Composite Link: 99.8 %  |
|------------------------------------------------------------------------|
|LOSS DUE TO ADJ. SAT. INTERFERENCE: TELS4 = 1.00dB, TELS6 = 1.00dB      |
--------------------------------------------------------------------------

Minn to 49 dBW Kzone, -26 dBW/Hz
 [ Input Data ]

 --------------------------------- SATELLITE ---------------------------------

 Satellite Name  : Galaxy-XI,91W        Location (deg W): 91.0 deg W
 Uplink Beam     : N_AMERICA_KVUP       Dnlink Beam     : N_AMERICA_KHDN
 Trans. BW  (MHz): 36.0 MHz             Trans. Type     : TWTA
 Uplink Pol.     : V                    Dnlink Pol.     : H
 Uplink Chan.    : 9K                   Dnlink Chan.    : 9K
 Uplink Frequency     (GHz): 14.180     Dnlink Frequency     (GHz): 11.880
 G/T, beam center    (dB/K): 4.81       EIRP, beam center    (dBW): 49.69
 G/T, beam edge      (dB/K): 1.0        EIRP, beam edge      (dBW): 46.0
 G/T, toward Tx ES   (dB/K): 4.0        EIRP, toward Rx ES   (dBW): 49
 SFD, beam edge    (dBW/m2): -86.8
 SFD, toward Tx ES (dBW/m2): -89.8

 --------------------------- OPERATING CONDITIONS ---------------------------

 Attenuator Setting (dB): 8.0           Nominal Uplink Co-Chan C/I (dB): 27.0
 Input Backoff      (dB): 8.0           Nominal Dnlink Co-Chan C/I (dB): 27.0
 Output Backoff     (dB): *             Minimum Uplink Rain Margin (dB):  3.5
 (C/Im) - Nominal   (dB): *             Actual  Uplink Rain Margin (dB):  2.2
 Min. System Margin (dB): 1.0           Uplink Power Control Margin(dB):  .0
 Max No Carriers / Trans: 28.15         Minimum Dnlink Rain Margin (dB):  4.5
 Required Link Availability: N/A        Actual  Dnlink Rain Margin (dB):  5.0
                                        Dnlink Pointing Error      (dB):  0.5

 -- ADJACENT SATELLITE INTERFERENCE ----- Sat. No. 1 -------- Sat. No. 2 -----

 Interfering Satellite Name           :      TELS4              TELS6
 Interfering Satellite Location(deg W):      89.0               93.0
 Uplink Interference    (dB or dBW/Hz):      -46.0              -46.0
 Uplink Polarization Advantage    (dB):      0.0                0.0
 Downlink Interference  (dB or dBW/Hz):      -26                -26
 Downlink Polarization Advantage  (dB):      0.0                0.0
 Tx E/S Topocentric Angle        (deg):      2.11               2.11
 Rx E/S Topocentric Angle        (deg):      2.13               2.13
 Rx E/S Adj. Sat. Discrimination  (dB):      20.5               20.5

 ---------------------------- CARRIER PARAMETERS ----------------------------

 Modem Type     : EF300                 C/N         (clear sky, dB): 4.10
 Modulation     : BPSK                  Eb/No       (clear sky, dB): 7.6
 Code Rate      : 1/2-V                 C/N   (rain conditions, dB): 3.00
 Info Rate (kbps): 512                  Eb/No (rain conditions, dB): 6.5
 Occupied Bandwidth  (kHz): 1146.9
 Allocated Bandwidth (kHz): 1450
```

------ Transmit Earth Station ------	------- Receive Earth Station -------
Location: USA__Minneapolis__MN	Location: 49 dBW
Latitude (deg N): 45.0	Latitude (deg N): 40
Longitude (deg W): 93.3	Longitude (deg W): 100
Altitude (m): *	Altitude (m): *
CCIR Rain Zone : K	CCIR Rain Zone : K
E/S Type or Model No: KPK	E/S Type or Model No: STANDARD
E/S Manufacturer : Vertex	E/S Manufacturer :
E/S Diam. (m): 6.1	E/S Diam. (m): 1.2
E/S Freq (nom, GHz): 14.250	E/S Freq (nom, GHz): 11.95
E/S Tx Gain (dBi): 57.15	E/S Gain (nom, dBi): 41.3
ULPC Margin (dB): .0	E/S Feed Loss (dB): 0.25
	E/S Ant. Temp(deg K): 45
	E/S LNA Temp (deg K): 85
	E/S G/T (nom, dB/K): *

Minn to 49 dBW Kzone, -24 dBW/Hz

SATELLITE DATA	Satellite : Galaxy-XI,91W		Location: 91.0 deg W Lon		
	Uplink Beam: N_AMERICA_KVUP		Dnlink Beam: N_AMERICA_KHDN		
	Uplink POL: V, Dnlink POL: H, EIRP, beam center: 49.69 dBW				
	G/T:4.0 dB/K, SFD:-89.8 dBW/m2		Dnlink EIRP: 49 dBW		
TRANSPONDER DATA	Trans Bandwidth :36.0 MHz		Trans Type: TWTA		
	Uplink Frequency:14.180 GHz		Dnlink Freq: 11.880 GHz		
	Aggregate IBO : 8.0 dB		Aggregate OBO: 4.6 dB		
CARRIER DATA	Type: EF300, Info Rate: 512 kbps, Mod: BPSK, 1/2-V				
	BWo: 1146.9kHz, BWa: 1450kHz, C/Nnom: 4.10dB, C/Nmin: 3.00d				
	LINK BUDGET			CLR SKY	UP FADE	DN FADE
	Earth Station EIRP		(dBW)	50.2	50.2	50.2
	- Uplink Path Loss, clear sky		(dB)	-207.1	-207.1	-207.1
	- Uplink Rain Attenuation		(dB)	0.0	-1.6	0.0
UPLINK PERFORMANCE	+ Satellite G/T		(dB/K)	4.0	4.0	4.0
	- Boltzman's Constant		(dBW/K-Hz)	228.6	228.6	228.6
	- Carrier Noise Bandwidth		(dB-Hz)	-60.6	-60.6	-60.6
	C/N Uplink		(dB)	15.2	13.6	15.2
	Satellite Saturation EIRP		(dBW)	49.0	49.0	49.0
	- Carrier Output Backoff		(dB)	-19.1	-20.7	-19.1
	Downlink EIRP per carrier		(dBW)	29.9	28.3	29.9
DOWNLINK PERFORMANCE	- Dnlink Path Loss, clear sky		(dB)	-205.4	-205.4	-205.4
	- Dnlink Rain Degradation		(dB)	0.0	0.0	-4.2
	- Antenna Pointing Error		(dB)	-.5	-.5	-.5
	+ Earth Station G/T, clear sky		(dB/K)	19.4	19.4	19.4
	- Boltzman's Constant		(dBW/K-Hz)	228.6	228.6	228.6
	- Carrier Noise Bandwidth		(dB-Hz)	-60.6	-60.6	-60.6
	C/N Dnlink		(dB)	11.4	9.8	7.1
	C/N Uplink		(dB)	15.2	13.6	15.2
	C/N Dnlink		(dB)	11.4	9.8	7.1
	C/I Intermod		(dB)	14.6	13.1	14.6
	C/I Uplink Co-channel		(dB)	26.5	24.9	26.5
	C/I Dnlink Co-Channel		(dB)	26.5	24.9	26.5
	C/I Uplink Adj. Sat. (TELS4)		(dB)	17.0	15.4	17.0
	C/I Dnlink Adj. Sat. (TELS4)		(dB)	13.3	11.7	13.3
	C/I Uplink Adj. Sat. (TELS6)		(dB)	17.0	15.4	17.0
	C/I Dnlink Adj. Sat. (TELS6)		(dB)	13.3	11.7	13.3
COMPOSITE PERFORMANCE						
	C/(N+I) COMPOSITE		(dB)	5.6	4.0	4.0
	- Required System Margin		(dB)	-1.0	-1.0	-1.0
	Net C/(N+I) COMPOSITE		(dB)	4.6	3.0	3.0
	- Minimum Required C/N		(dB)	-4.1	-3.0	-3.0
	Excess Link Margin		(dB)	.5	0.0	0.0
TRANSPONDER UTILIZATION	% BW/CARR: 4.03, % PWR/CARR: 3.55, Max No. Carriers: 24.8					
	Downlink EIRP per carrier toward beam center: 30.6 dBW					
TRANSMIT EARTH STA.	Loc: USA__Minneapolis__ ID:KPK		AZ: 176.7 Elev: 38.1			
	EIRP per carrier: 50.2 dBW,	Carrier Pwr: 0.2 watts				

```
|RECEIVE E.S.|Loc: 49 dBW            ID:STANDARD    AZ: 166.2 Elev: 42.8 |
|------------------------------------------------------------------------|
|INTERFERENCE|Uplink Pwr Den: -67.5 dBW/Hz, Dnlink EIRP Den: -30.0 dBW/Hz |
|INFORMATION |Max Dnlink PFD: -156.5 dB(W/m2/4kHz) @ Beam Center          |
|------------------------------------------------------------------------|
|LINK        |Uplink: Zone K ,  Dnlink: Zone K                           |
|AVAILABILITY|Uplink: 99.78 %,  Dnlink: 99.91 %,  Composite Link: 99.69 % |
|------------------------------------------------------------------------|
|LOSS DUE TO ADJ. SAT. INTERFERENCE: TELS4 = 1.21dB, TELS6 = 1.21dB      |
--------------------------------------------------------------------------

Minn to 49 dBW Kzone, -24 dBW/Hz
[ Input Data ]

--------------------------------- SATELLITE ---------------------------------

Satellite Name  : Galaxy-XI,91W       Location (deg W): 91.0 deg W
Uplink Beam     : N_AMERICA_KVUP      Dnlink Beam     : N_AMERICA_KHDN
Trans. BW  (MHz): 36.0 MHz            Trans. Type     : TWTA
Uplink Pol.     : V                   Dnlink Pol.     : H
Uplink Chan.    : 9K                  Dnlink Chan.    : 9K
Uplink Frequency     (GHz): 14.180    Dnlink Frequency     (GHz): 11.880
G/T, beam center    (dB/K): 4.81      EIRP, beam center    (dBW): 49.69
G/T, beam edge      (dB/K): 1.0       EIRP, beam edge      (dBW): 46.0
G/T, toward Tx ES   (dB/K): 4.0       EIRP, toward Rx ES   (dBW): 49
SFD, beam edge    (dBW/m2): -86.8
SFD, toward Tx ES (dBW/m2): -89.8

--------------------------- OPERATING CONDITIONS ---------------------------

Attenuator Setting (dB): 8.0          Nominal Uplink Co-Chan C/I (dB): 27.0
Input Backoff      (dB): 8.0          Nominal Dnlink Co-Chan C/I (dB): 27.0
Output Backoff     (dB): *            Minimum Uplink Rain Margin (dB):  3.5
(C/Im) - Nominal   (dB): *            Actual  Uplink Rain Margin (dB):  1.6
Min. System Margin (dB): 1.0          Uplink Power Control Margin(dB):  .0
Max No Carriers / Trans: 28.15        Minimum Dnlink Rain Margin (dB):  4.5
Required Link Availability: N/A       Actual  Dnlink Rain Margin (dB):  4.2
                                      Dnlink Pointing Error      (dB):  0.5

-- ADJACENT SATELLITE INTERFERENCE ----- Sat. No. 1 -------- Sat. No. 2 -----

Interfering Satellite Name           :      TELS4              TELS6
Interfering Satellite Location(deg W):      89.0               93.0
Uplink Interference    (dB or dBW/Hz):      -46.0              -46.0
Uplink Polarization Advantage    (dB):      0.0                0.0
Downlink Interference  (dB or dBW/Hz):      -24                -24
Downlink Polarization Advantage  (dB):      0.0                0.0
Tx E/S Topocentric Angle        (deg):      2.11               2.11
Rx E/S Topocentric Angle        (deg):      2.13               2.13
Rx E/S Adj. Sat. Discrimination  (dB):      20.5               20.5

---------------------------- CARRIER PARAMETERS ----------------------------

Modem Type     : EF300                C/N         (clear sky, dB): 4.10
Modulation     : BPSK                 Eb/No       (clear sky, dB): 7.6
Code Rate      : 1/2-V                C/N   (rain conditions, dB): 3.00
Info Rate (kbps): 512                 Eb/No (rain conditions, dB): 6.5
Occupied Bandwidth  (kHz): 1146.9
Allocated Bandwidth (kHz): 1450
```

------ Transmit Earth Station ------	------- Receive Earth Station -------
Location: USA__Minneapolis__MN	Location: 49 dBW
Latitude (deg N): 45.0	Latitude (deg N): 40
Longitude (deg W): 93.3	Longitude (deg W): 100
Altitude (m): *	Altitude (m): *
CCIR Rain Zone : K	CCIR Rain Zone : K
E/S Type or Model No: KPK	E/S Type or Model No: STANDARD
E/S Manufacturer : Vertex	E/S Manufacturer :
E/S Diam. (m): 6.1	E/S Diam. (m): 1.2
E/S Freq (nom, GHz): 14.250	E/S Freq (nom, GHz): 11.95
E/S Tx Gain (dBi): 57.15	E/S Gain (nom, dBi): 41.3
ULPC Margin (dB): .0	E/S Feed Loss (dB): 0.25
	E/S Ant. Temp(deg K): 45
	E/S LNA Temp (deg K): 85
	E/S G/T (nom, dB/K): *

1 dB G/T Kzone to Minn, -24 dBW/Hz

SATELLITE DATA	Satellite : Galaxy-XI,91W		Location: 91 deg W Lon		
	Uplink Beam: N_AMERICA_KVUP		Dnlink Beam: N_AMERICA_KHDN		
	Uplink POL: V, Dnlink POL: H, EIRP, beam center: 49.69 dBW				
	G/T:1 dB/K, SFD:-86.8 dBW/m2		Dnlink EIRP: 47.0 dBW		
TRANSPONDER DATA	Trans Bandwidth :36.0 MHz		Trans Type: TWTA		
	Uplink Frequency:14.180 GHz		Dnlink Freq: 11.880 GHz		
	Aggregate IBO : 8.0 dB		Aggregate OBO: 4.6 dB		
CARRIER DATA	Type: EF300, Info Rate: 128 kbps, Mod: BPSK, 1/2-V				
	BWo: 286.7kHz, BWa: 375kHz, C/Nnom: 4.10dB, C/Nmin: 3.00dB				
	LINK BUDGET			CLR SKY	UP FADE	DN FADE
UPLINK PERFORMANCE	Earth Station EIRP	(dBW)		43.3	43.3	43.3
	- Uplink Path Loss, clear sky	(dB)		-207.0	-207.0	-207.0
	- Uplink Rain Attenuation	(dB)		0.0	-1.4	0.0
	+ Satellite G/T	(dB/K)		1.0	1.0	1.0
	- Boltzman's Constant	(dBW/K-Hz)		228.6	228.6	228.6
	- Carrier Noise Bandwidth	(dB-Hz)		-54.6	-54.6	-54.6
	C/N Uplink	(dB)		11.4	10.0	11.4
DOWNLINK PERFORMANCE	Satellite Saturation EIRP	(dBW)		47.0	47.0	47.0
	- Carrier Output Backoff	(dB)		-28.9	-30.3	-28.9
	Downlink EIRP per carrier	(dBW)		18.1	16.7	18.1
	- Dnlink Path Loss, clear sky	(dB)		-205.5	-205.5	-205.5
	- Dnlink Rain Degradation	(dB)		0.0	0.0	-9.1
	- Antenna Pointing Error	(dB)		-.5	-.5	-.5
	+ Earth Station G/T, clear sky	(dB/K)		33.6	33.6	33.6
	- Boltzman's Constant	(dBW/K-Hz)		228.6	228.6	228.6
	- Carrier Noise Bandwidth	(dB-Hz)		-54.6	-54.6	-54.6
	C/N Dnlink	(dB)		19.7	18.2	10.6
	C/N Uplink	(dB)		11.4	10.0	11.4
	C/N Dnlink	(dB)		19.7	18.2	10.6
	C/I Intermod	(dB)		10.8	9.4	10.8
	C/I Uplink Co-channel	(dB)		22.5	21.1	22.5
	C/I Dnlink Co-Channel	(dB)		22.5	21.1	22.5
	C/I Uplink Adj. Sat. (TELS4)	(dB)		13.2	11.8	13.2
	C/I Dnlink Adj. Sat. (TELS4)	(dB)		21.7	20.2	21.7
	C/I Uplink Adj. Sat. (TELS6)	(dB)		13.2	11.8	13.2
	C/I Dnlink Adj. Sat. (TELS6)	(dB)		21.7	20.2	21.7
COMPOSITE PERFORMANCE	C/(N+I) COMPOSITE	(dB)		5.4	4.0	4.4
	- Required System Margin	(dB)		-1.0	-1.0	-1.0
	Net C/(N+I) COMPOSITE	(dB)		4.4	3.0	3.4
	- Minimum Required C/N	(dB)		-4.1	-3.0	-3.0
	Excess Link Margin	(dB)		.3	0.0	.4
TRANSPONDER UTILIZATION	% BW/CARR: 1.04, % PWR/CARR: 0.37, Max No. Carriers: 96.0					
	Downlink EIRP per carrier toward beam center: 20.8 dBW					
TRANSMIT EARTH STA.	Loc: 1 dB G/T		ID:STANDARD	AZ: 166.2 Elev: 42.8		
	EIRP per carrier: 43.3 dBW,		Carrier Pwr: 1.1 watts			

```
|RECEIVE E.S.|Loc: USA__Minneapolis__ ID:KPK        AZ: 176.7 Elev: 38.1 |
|-----------------------------------------------------------------------|
|INTERFERENCE|Uplink Pwr Den: -54.1 dBW/Hz, Dnlink EIRP Den: -33.8 dBW/Hz |
|INFORMATION |Max Dnlink PFD: -160.4 dB(W/m2/4kHz) @ Beam Center          |
|-----------------------------------------------------------------------|
|LINK        |Uplink: Zone K ,  Dnlink: Zone K                          |
|AVAILABILITY|Uplink: 99.71 %,  Dnlink: 99.99 %,  Composite Link: 99.7 %  |
|-----------------------------------------------------------------------|
|LOSS DUE TO ADJ. SAT. INTERFERENCE: TELS4 = 0.92dB, TELS6 = 0.92dB      |
-------------------------------------------------------------------------

1 dB G/T Kzone to Minn, -24 dBW/Hz
[ Input Data ]

--------------------------------- SATELLITE ---------------------------------

Satellite Name  : Galaxy-XI,91W        Location (deg W):  91 deg W
Uplink Beam     : N_AMERICA_KVUP       Dnlink Beam     : N_AMERICA_KHDN
Trans. BW  (MHz): 36.0 MHz             Trans. Type     : TWTA
Uplink Pol.     : V                    Dnlink Pol.     : H
Uplink Chan.    : 9K                   Dnlink Chan.    : 9K
Uplink Frequency     (GHz): 14.180     Dnlink Frequency     (GHz): 11.880
G/T, beam center    (dB/K): 4.81       EIRP, beam center    (dBW): 49.69
G/T, beam edge      (dB/K): 1.0        EIRP, beam edge      (dBW): 46.0
G/T, toward Tx ES   (dB/K): 1          EIRP, toward Rx ES   (dBW): 47.0
SFD, beam edge    (dBW/m2): -86.8
SFD, toward Tx ES (dBW/m2): -86.8

--------------------------- OPERATING CONDITIONS ---------------------------

Attenuator Setting (dB): 8.0           Nominal Uplink Co-Chan C/I (dB): 27.0
Input Backoff      (dB): 8.0           Nominal Dnlink Co-Chan C/I (dB): 27.0
Output Backoff     (dB): *             Minimum Uplink Rain Margin (dB):  0.5*
(C/Im) - Nominal   (dB): *             Actual  Uplink Rain Margin (dB):  1.4
Min. System Margin (dB): 1.0           Uplink Power Control Margin(dB):  .0
Max No Carriers / Trans: 270           Minimum Dnlink Rain Margin (dB):  0.5*
Required Link Availability: *          Actual  Dnlink Rain Margin (dB):  9.1
                                       Dnlink Pointing Error      (dB):  0.5

-- ADJACENT SATELLITE INTERFERENCE ----- Sat. No. 1 -------- Sat. No. 2 -----

Interfering Satellite Name           :      TELS4              TELS6
Interfering Satellite Location(deg W):      89.0               93.0
Uplink Interference    (dB or dBW/Hz):      -46.0              -46.0
Uplink Polarization Advantage    (dB):      0.0                0.0
Downlink Interference  (dB or dBW/Hz):      -24                -24
Downlink Polarization Advantage  (dB):      0.0                0.0
Tx E/S Topocentric Angle        (deg):      2.13               2.13
Rx E/S Topocentric Angle        (deg):      2.11               2.11
Rx E/S Adj. Sat. Discrimination  (dB):      34.7               34.7

--------------------------- CARRIER PARAMETERS ---------------------------

Modem Type     : EF300                 C/N         (clear sky, dB): 4.10
Modulation     : BPSK                  Eb/No       (clear sky, dB): 7.6
Code Rate      : 1/2-V                 C/N   (rain conditions, dB): 3.00
Info Rate (kbps): 128                  Eb/No (rain conditions, dB): 6.5
Occupied Bandwidth  (kHz): 286.7
Allocated Bandwidth (kHz): 375
```

------ Transmit Earth Station ------		------- Receive Earth Station -------	
Location:	1 dB G/T	Location:	USA__Minneapolis__MN
Latitude (deg N):	40	Latitude (deg N):	45.0
Longitude (deg W):	100	Longitude (deg W):	93.3
Altitude (m):	*	Altitude (m):	*
CCIR Rain Zone :	K	CCIR Rain Zone :	K
E/S Type or Model No:	STANDARD	E/S Type or Model No:	KPK
E/S Manufacturer :		E/S Manufacturer :	Vertex
E/S Diam. (m):	1.2	E/S Diam. (m):	6.1
E/S Freq (nom, GHz):	14.250	E/S Freq (nom, GHz):	11.95
E/S Tx Gain (dBi):	42.9	E/S Gain (nom, dBi):	55.6
ULPC Margin (dB):	.0	E/S Feed Loss (dB):	0.25
		E/S Ant. Temp(deg K):	55
		E/S LNA Temp (deg K):	80
		E/S G/T (nom, dB/K):	*

1 dB G/T Kzone to Minn, -30 dBW/Hz

SATELLITE DATA	Satellite : Galaxy-XI,91W		Location: 91 deg W Lon		
	Uplink Beam: N_AMERICA_KVUP		Dnlink Beam: N_AMERICA_KHDN		
	Uplink POL: V, Dnlink POL: H, EIRP, beam center: 49.69 dBW				
	G/T:1 dB/K, SFD:-86.8 dBW/m2		Dnlink EIRP: 47.0 dBW		
TRANSPONDER DATA	Trans Bandwidth :36.0 MHz		Trans Type: TWTA		
	Uplink Frequency:14.180 GHz		Dnlink Freq: 11.880 GHz		
	Aggregate IBO : 8.0 dB		Aggregate OBO: 4.6 dB		
CARRIER DATA	Type: EF300, Info Rate: 128 kbps, Mod: BPSK, 1/2-V				
	BWo: 286.7kHz, BWa: 375kHz, C/Nnom: 4.10dB, C/Nmin: 3.00dB				
	LINK BUDGET			CLR SKY	UP FADE	DN FADE
UPLINK PERFORMANCE	Earth Station EIRP	(dBW)		43.3	43.3	43.3
	- Uplink Path Loss, clear sky	(dB)		-207.0	-207.0	-207.0
	- Uplink Rain Attenuation	(dB)		0.0	-1.6	0.0
	+ Satellite G/T	(dB/K)		1.0	1.0	1.0
	- Boltzman's Constant	(dBW/K-Hz)		228.6	228.6	228.6
	- Carrier Noise Bandwidth	(dB-Hz)		-54.6	-54.6	-54.6
	C/N Uplink	(dB)		11.4	9.8	11.4
DOWNLINK PERFORMANCE	Satellite Saturation EIRP	(dBW)		47.0	47.0	47.0
	- Carrier Output Backoff	(dB)		-29.0	-30.6	-29.0
	Downlink EIRP per carrier	(dBW)		18.0	16.4	18.0
	- Dnlink Path Loss, clear sky	(dB)		-205.5	-205.5	-205.5
	- Dnlink Rain Degradation	(dB)		0.0	0.0	-10.9
	- Antenna Pointing Error	(dB)		-.5	-.5	-.5
	+ Earth Station G/T, clear sky	(dB/K)		33.6	33.6	33.6
	- Boltzman's Constant	(dBW/K-Hz)		228.6	228.6	228.6
	- Carrier Noise Bandwidth	(dB-Hz)		-54.6	-54.6	-54.6
	C/N Dnlink	(dB)		19.6	18.0	8.7
COMPOSITE PERFORMANCE	C/N Uplink	(dB)		11.4	9.8	11.4
	C/N Dnlink	(dB)		19.6	18.0	8.7
	C/I Intermod	(dB)		10.8	9.2	10.8
	C/I Uplink Co-channel	(dB)		22.5	20.9	22.5
	C/I Dnlink Co-Channel	(dB)		22.5	20.9	22.5
	C/I Uplink Adj. Sat. (TELS4)	(dB)		13.1	11.5	13.1
	C/I Dnlink Adj. Sat. (TELS4)	(dB)		27.6	26.0	27.6
	C/I Uplink Adj. Sat. (TELS6)	(dB)		13.2	11.6	13.2
	C/I Dnlink Adj. Sat. (TELS6)	(dB)		27.6	26.0	27.6
	C/(N+I) COMPOSITE	(dB)		5.5	4.0	4.0
	- Required System Margin	(dB)		-1.0	-1.0	-1.0
	Net C/(N+I) COMPOSITE	(dB)		4.5	3.0	3.0
	- Minimum Required C/N	(dB)		-4.1	-3.0	-3.0
	Excess Link Margin	(dB)		.4	0.0	0.0
TRANSPONDER UTILIZATION	% BW/CARR: 1.04, % PWR/CARR: 0.37, Max No. Carriers: 96.0					
	Downlink EIRP per carrier toward beam center: 20.7 dBW					
TRANSMIT EARTH STA.	Loc: 1 dB G/T		ID:STANDARD	AZ: 166.2 Elev: 42.8		
	EIRP per carrier: 43.3 dBW,		Carrier Pwr: 1.1 watts			

```
|RECEIVE E.S.|Loc: USA__Minneapolis__ ID:KPK        AZ: 176.7 Elev: 38.1 |
|------------------------------------------------------------------------|
|INTERFERENCE|Uplink Pwr Den: -54.1 dBW/Hz, Dnlink EIRP Den: -33.8 dBW/Hz |
|INFORMATION |Max Dnlink PFD: -160.4 dB(W/m2/4kHz) @ Beam Center          |
|------------------------------------------------------------------------|
|LINK        |Uplink: Zone K ,  Dnlink: Zone K                           |
|AVAILABILITY|Uplink: 99.76 %,  Dnlink: 99.99 %,  Composite Link: 99.75 % |
|------------------------------------------------------------------------|
|LOSS DUE TO ADJ. SAT. INTERFERENCE: TELS4 = 0.86dB, TELS6 = 0.86dB      |
--------------------------------------------------------------------------

1 dB G/T Kzone to Minn, -30 dBW/Hz
 [ Input Data ]

 --------------------------------- SATELLITE ---------------------------------

 Satellite Name  : Galaxy-XI,91W        Location (deg W):  91 deg W
 Uplink Beam     : N_AMERICA_KVUP       Dnlink Beam     : N_AMERICA_KHDN
 Trans. BW  (MHz): 36.0 MHz             Trans. Type     : TWTA
 Uplink Pol.     : V                    Dnlink Pol.     : H
 Uplink Chan.    : 9K                   Dnlink Chan.    : 9K
 Uplink Frequency     (GHz): 14.180     Dnlink Frequency     (GHz): 11.880
 G/T, beam center    (dB/K): 4.81       EIRP, beam center    (dBW): 49.69
 G/T, beam edge      (dB/K): 1.0        EIRP, beam edge      (dBW): 46.0
 G/T, toward Tx ES   (dB/K): 1          EIRP, toward Rx ES   (dBW): 47.0
 SFD, beam edge    (dBW/m2): -86.8
 SFD, toward Tx ES (dBW/m2): -86.8

 --------------------------- OPERATING CONDITIONS ---------------------------

 Attenuator Setting (dB): 8.0           Nominal Uplink Co-Chan C/I (dB): 27.0
 Input Backoff      (dB): 8.0           Nominal Dnlink Co-Chan C/I (dB): 27.0
 Output Backoff     (dB): *             Minimum Uplink Rain Margin (dB):  0.5*
 (C/Im) - Nominal   (dB): *             Actual  Uplink Rain Margin (dB):  1.6
 Min. System Margin (dB): 1.0           Uplink Power Control Margin(dB):  .0
 Max No Carriers / Trans: *             Minimum Dnlink Rain Margin (dB):  0.5*
 Required Link Availability: 99.75      Actual  Dnlink Rain Margin (dB):  10.9
                                        Dnlink Pointing Error      (dB):  0.5

 -- ADJACENT SATELLITE INTERFERENCE ----- Sat. No. 1 -------- Sat. No. 2 -----

 Interfering Satellite Name           :      TELS4              TELS6
 Interfering Satellite Location(deg W):      89.0               93.0
 Uplink Interference    (dB or dBW/Hz):      -46.0              -46.0
 Uplink Polarization Advantage    (dB):      0.0                0.0
 Downlink Interference  (dB or dBW/Hz):      -30                -30
 Downlink Polarization Advantage  (dB):      0.0                0.0
 Tx E/S Topocentric Angle        (deg):      2.13               2.13
 Rx E/S Topocentric Angle        (deg):      2.11               2.11
 Rx E/S Adj. Sat. Discrimination  (dB):      34.7               34.7

 --------------------------- CARRIER PARAMETERS ---------------------------

 Modem Type     : EF300                 C/N         (clear sky, dB): 4.10
 Modulation     : BPSK                  Eb/No       (clear sky, dB): 7.6
 Code Rate      : 1/2-V                 C/N   (rain conditions, dB): 3.00
 Info Rate (kbps): 128                  Eb/No (rain conditions, dB): 6.5
 Occupied Bandwidth  (kHz): 286.7
 Allocated Bandwidth (kHz): 375
```

------ Transmit Earth Station ------		------- Receive Earth Station -------	
Location:	1 dB G/T	Location:	USA__Minneapolis__MN
Latitude (deg N):	40	Latitude (deg N):	45.0
Longitude (deg W):	100	Longitude (deg W):	93.3
Altitude (m):	*	Altitude (m):	*
CCIR Rain Zone :	K	CCIR Rain Zone :	K
E/S Type or Model No:	STANDARD	E/S Type or Model No:	KPK
E/S Manufacturer :		E/S Manufacturer :	Vertex
E/S Diam. (m):	1.2	E/S Diam. (m):	6.1
E/S Freq (nom, GHz):	14.250	E/S Freq (nom, GHz):	11.95
E/S Tx Gain (dBi):	42.9	E/S Gain (nom, dBi):	55.6
ULPC Margin (dB):	.0	E/S Feed Loss (dB):	0.25
		E/S Ant. Temp(deg K):	55
		E/S LNA Temp (deg K):	80
		E/S G/T (nom, dB/K):	*